PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference UMD-0015	**FOR FURTHER ACTION**	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/US03/34683	International filing date (*day/month/year*) 31 October 2003 (31.10.2003)	(Earliest) Priority Date (*day/month/year*) 20 December 2002 (20.12.2002)
Applicant UNIVERSITY OF MEDICINE AND DENTISTRY OF NEW JERSEY		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 10 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the Report**
   a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
   ☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
   b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:
   ☒ contained in the international application in written form.
   ☒ filed together with the international application in computer readable form.
   ☐ furnished subsequently to this Authority in written form.
   ☐ furnished subsequently to this Authority in computer readable form.
   ☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   ☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.
2. ☒ Certain claims were found unsearchable (See Box I).
3. ☒ Unity of invention is lacking (See Box II).
4. With regard to the title,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No. _____
   ☐ as suggested by the applicant. ☒ None of the figures
   ☐ because the applicant failed to suggest a figure.
   ☐ because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/34683

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☒ Claim Nos.: 5-7
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest
☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

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International application No.

PCT/US03/34683

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : C12N 1/21, 9/28, 15/52; C12Q 1/34, 1/68; C07H 21/04; A61K 38/47

US CL : 536/23.2, 23.4; 435/4, 6, 22, 202, 252.3, 252.5, 440; 424/94.61

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 536/23.2, 23.4; 435/4, 6, 22, 202, 252.3, 252.5, 440; 424/94.61

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	GRAHAM et al. Molecular Cloning of the cDNA Which Encodes beta-N-Acetylhexoaminidase A from Dictyostelium discoideum. The Journal of Biological Chemistry. 15 November 1998 (19.11.1998), Vol. 263. No.32, pages 16823-16829, especially page 16823 and page 16827, Figure 4. The amino acid sequence (532 amino acids) is 12.5% identical to SEQ ID NO:2.	1,8,10-15 --- 20-31
X --- A	SOMERVILLE et al. Sequence Analysis of the beta-N-Acetylhexosaminidase Gene of Vibrio vulnificus: Evidence for a Common Evolutionary Origin of Hexosaminidases. Proc. Natl. Acad. Sci. USA. Juky 1993, Vol. 90, pages 6751-6755, especially page 6751 and page 6753, Figure 2. The amino acid sequence (847 amino acids) is 11.6% identical to SEQID	1, 4, 8, 10 --- 2, 3, 9, 11-34
X --- Y	CLARKE et al. Cloning and Expression of the beta-N-Acetylglucosaminidase Gene from Streptococcus phemoniae. The Journal of Biological Chemistry. 14 April 1995, vol. 270. No. 15, pages 8805-8814, especially page 8805 and pages 8808-8809, Figure 3. The amino acid sequence (1312 amino acids) is 13.6% identical to SEQ ID NO:2.	1, 4, 8, 8, 10, 11 --- 12-34
X --- Y	WO 98/50512 (CONVENTS et al) 12 November 1998 (12.11.1998), especially pages 1, 2, 6. The amino acid sequence (847 amino acids) is 11.6% identical to SEQ ID NO:2.	1, 4, 8, 10, 15, 21, 22 --- 11-14, 17, 20, 23-31

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"B" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

25 April 2005 (25.04.2005)

Date of mailing of the international search report

13 MAY 2005

Name and mailing address of the ISA/US

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Form PCT/ISA/210 (second sheet) (July 1998)

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C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, P	KAPLAN et al. Detachment of Actinobacillus actinomycetemcomitans Biofilm Cells by an Endogenous beta-Hexosaminidase Activity. Journal of Bacteriology. August 2003, Vol. 185. No. 16, pages 4693-4698.	1-34

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BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claim(s) 1-4, 21 (in part) and 32-34, drawn to a nucleic acid encoding an β-N-acetylglucosaminidase, a method of use and a pair of primers.

Group II, claim(s) 8-11, 13-15, 21 (in part) and 22-25, drawn to β-N-acetylglucosaminidase and *in vitro* methods of use thereof.

Group III, claim(s) 16, drawn to a method mutating a *dspB* gene.

Group IV, claim(s) 17 and 20 (both in part), drawn to a method decreasing the expression of β-N-acetylglucosaminidase and a method for identifying the agent.

Group V, claim(s) 17 and 20 (both in part), drawn to a method decreasing the activity of β-N-acetylglucosaminidase and a method for identifying the agent.

Group VI, claim(s) 18 and 19 (both in part), drawn to a mutant strain of *Actinobacillus actinomycetemcomitans*.

Group VII, claim(s) 12 and 26-31, drawn to methods of treatment using an β-N-acetylglucosaminidase.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: a nucleic acid encoding an β-N-acetylglucosaminidase and an β-N-acetylglucosaminidase do not share a special technical feature because neither makes a contribution over the prior art as evidenced by Graham et al (1988).

The inventions listed as Groups I-V lack the same or corresponding special technical features because the strucuture of an agent identified and/or used in Groups III-V is unpredictable from the structure of an β-N-acetylglucosaminidase.

The inventions listed as Groups I-V lack the same or corresponding special technical features with the strain of Group VI because Groups I-V are directed to isolated compounds characterized by a single chemical structure whereas the strain of Group VI comprises many compounds that act in concert.

Methods of Groups I-VII do not share a special technical feature as drawn to methods of use of compounds that do not share a special technical feature.

While methods of Group II and Group VII are methods of use of an β-N-acetylglucosaminidase, they use different protocols, produce different effects and have different utilities.

37 CFR 1.475 does not provide for multiple products or methods within a single application and therefore, unity of invention is lacking with regard to Groups I-VII.

of an agent identified and/or used in Groups III-V is unpredictable from the structure of an β-N-acetylglucosaminidase.

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In order for more than one species to be examined, the appropriate additional examination fees must be paid. The species are as follows:

A nucleic acid encoding an β-N-acetylglucosaminidase of SEQ ID NO:1, 3, 5, 7 or 9 or an β-N-acetylglucosaminidase of SEQ ID NO:2, 4, 6, 8 or 10.

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The following claim(s) are generic: 1-4, 8-34.

The species listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons: β-N-acetylglucosaminidases of SEQ ID NO:2, 4, 6, 8 or 10 and nucleic acids encoding thereof have different structures. No structural feature is disclosed as responsible for the β-N-acetylglucosaminidase activity. Therefore, where the structural identity is required such as for the expression or therapeutic effects, said species will produce different effects.

Continuation of B. FIELDS SEARCHED Item 3:
WEST, STN cluster (MEDLINE, HCAPLUS, BIOSIS, SCISEARCH). Search terms: hexoaminidase or glucoaminidase, gene or sequence, mutant or variant, Actinobacillus or actinomycetemcomitans